

## Biosensors for Exploration Medical System (PI=Winther)

Completed Technology Project (2011 - 2016)



## Project Introduction

The current International Space Station (ISS) electrocardiogram (ECG) system for donning the biomedical sensors is time consuming and inconvenient, requiring shaving, application of electrodes, and signal checks. A more efficient ECG system will save crew time and reduce the overhead of stowing additional supplies. Additionally, the current ECG hardware requires dedicated ISS power and significant volume, but advances in microelectronics has significantly reduced the volume and power required for ECG applications. The Biosensors-EMSD (Exploration Medical System Demonstration) will demonstrate the integration of small, battery powered, easy to use biomedical sensors and data acquisition devices that will have the ability to measure, store, and transmit physiologic parameters during operational and ambulatory scenarios.

### Specific Aims:

1. Demonstrate that commercial off the shelf (COTS) and emerging technologies satisfy exploration physiological monitoring requirements and operational requirements
2. Reduce the time required of an on-orbit crew and ground personnel to store, access, transfer, and process physiological data
3. Provide a mechanism for interfacing biomedical sensor technology with a common data management framework and architecture to enable the EMSD objectives.

The functionality of the ECG system will be verified through a ground demonstration and an ISS flight demonstration, both as part of the Exploration Medical System Demonstration. The project will begin with a market survey of available COTS ECG systems that meet physiological monitoring requirements followed by a direct COTS procurement. The ECG system will then be tested and verified for proper capabilities by CMO analogs. Ground testing will require CMO analogs to don the ECG system and execute a series of predetermined tasks while a variety of ECG data and video is collected. ECG data and video will be examined to ensure data quality, appropriate data routing, and to demonstrate system efficiency. Flight testing will be similar to ground testing, but may not be as comprehensive given in-flight resource limitations. The availability of more varied medical condition simulations, more extensive supply of power, fewer time and space limitations, and enhanced system characterization capabilities will allow the ground demonstration to expand the on-orbit objectives by assessing system effectiveness and performance.

NOTE: Project completed 6/30/2016 with transfer to Medical Operations at Johnson Space Center.

## Anticipated Benefits



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For more information and an accessible alternative, please visit:  
<https://techport.nasa.gov/view/34472>



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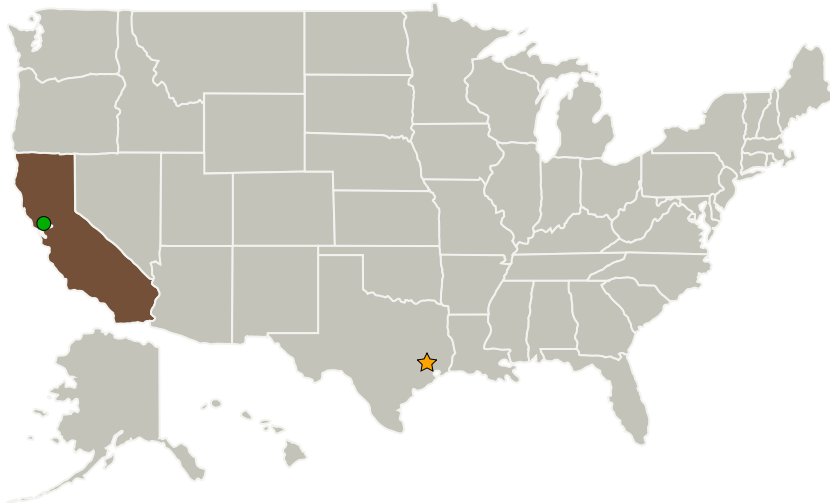
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Our purpose is to better equip crew member medical monitoring for future exploration missions.

## Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★ Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California
Dynamac Corp.	Supporting Organization	Industry	

## Primary U.S. Work Locations

California

## Project Transitions



July 2011: Project Start

## Organizational Responsibility

## Responsible Mission Directorate:

Space Operations Mission Directorate (SOMD)

## Lead Center / Facility:

Johnson Space Center (JSC)

## Responsible Program:

Human Spaceflight Capabilities

## Project Management

## Program Director:

David K Baumann

## Project Manager:

Erik L Antonsen

## Principal Investigator:

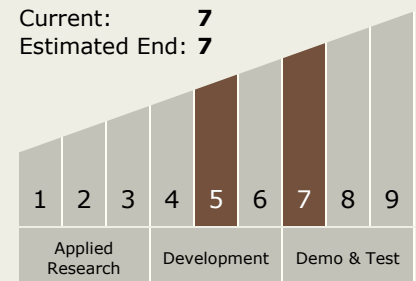
Sean W Winther

## Co-Investigator:

William B Toscano

## Technology Maturity (TRL)

Start: 5  
Current: 7  
Estimated End: 7



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**June 2016:** Closed out

**Closeout Summary:** The following items are critical topics for this task. Most of the work has been a continuation from last year; however, the scope of the hardware need has changed. With that in mind, our intentions for this project remain to be a demonstration or operational use on board International Space Station. ECG Device: No additional work has been done with this device and they remain in bonded storage at Ames Research Center (ARC). ECG Harness Development: The 12-Lead ECG Dry Electrode Harnesses have been delivered and remain in bonded storage at ARC. System has been demonstrated to potential stakeholders (Health Maintenance System (HMS) and Countermeasures System (CMS), and Medical Operations (MedOPs)); however, there has been no final decision to move forward for a flight manifest. ECG Glove: The Glove was purchased and demonstrated with the ECG device. The potential stakeholders (HMS, CMS, HHC, and MedOPs) were interested. Currently, HMS has decided to move forward with the ECG glove and ECG device into flight status. Procedure Development and Demonstration: Functional test procedures were developed and demonstrated for the ECG device. Procedures were written to fully satisfy qualification and acceptance for flight. Ground demonstrations procedures were developed and tested as a foundation for flight procedures. Flight procedures have been developed and completed for both the ECG device and ECG glove. Flight Certification: The flight safety data package O/I/II was completed and accepted. Flight Data Safety Package III draft has been completed and final draft will be submitted May 2016. Flight Protocol Approval: Notification of Approval was received from Johnson Space Center (JSC's) IRB (Institutional Review Board) and is effective April 13, 2016 – April 30, 2017. Protocol Number: Pro1569; NASA MPA Number: NASA 71163016 06HR; FWA Number: 00019876. NOTE: Project completed 6/30/2016 with transfer to Medical Operations at Johnson Space Center.

**Project Website:**
<https://taskbook.nasaprs.com>
**Technology Areas****Primary:**

- TX06 Human Health, Life Support, and Habitation Systems
  - └ TX06.3 Human Health and Performance
    - └ TX06.3.1 Medical Diagnosis and Prognosis

**Target Destinations**

The Moon, Mars